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Abstract

**Introduction**—Intravascular ultrasonography (IVUS) has been shown as a valuable adjunct imaging tool during endovascular procedures but its value in detection of any recurrence during follow up after endovascular coil embolization of large and giant intracranial aneurysms is not reported.

**Methods**—A 41 years old man who had been treated using stent assisted coil embolization for cavernous segment aneurysm of the left internal carotid artery underwent 60 month angiographic follow up. Concurrently, IVUS catheter was advanced under fluoroscopic guidance inside the cavernous portion of the left internal carotid artery. Then IVUS images were used to visualize the stent, coil loops, and aneurysm neck.

**Results**—The angiographic images were limited because of superimposition of the aneurysm on the parent vessel in all projections. IVUS images demonstrated that the stent was patent along its whole length and there was no sign of stent deformity or in-stent thrombosis. Loops of the coil were visualized as hyper-echoic signals inside the aneurysm and there was no sign of herniated loops of coil inside the stent.

**Conclusion**—In this case report, we observed that adjunct use of IVUS can provide valuable information not ascertained by angiography during follow up assessment of coil embolized aneurysm.

**Keywords**

Intravascular Ultrasonography; Aneurysm; Coil Embolization; Stent

**Background**

Giant intracranial aneurysms with fundus diameters of 25mm or more comprise approximately 5% of all intracranial aneurysms.1, 2 While surgical clipping of these aneurysms is very challenging with high morbidity rate,3, 4 endovascular embolization has emerged as an acceptable first line treatment option with relatively low morbidity.5, 6 However, aneurysm re-growth, coil compaction, and/or new growth of aneurysm occurs frequently after endovascular embolization of large aneurysms. Therefore, long-term angiographic follow up is mandatory after the initial embolization procedure.7 However, angiographic images are often complicated by superimposition of the aneurysm on the parent vessel obscuring visualization of the aneurysm parent vessel junction. In this study, we report on the feasibility of using intravascular ultrasonography (IVUS) during follow-up monitoring for carotid cavernous aneurysms treated with coil embolization and stent placement.

**Case Description**

A 41 year old man with a history of coil embolization of the left cavernous segment large aneurysm 5 years ago and covered stent (Jo-Stent) placement across the neck of the aneurysm 4 years ago underwent a 60 month follow up angiogram. The patient consented for the angiogram and IVUS procedure.

Under fluoroscopic guidance, 6F catheter was advanced into the left internal carotid artery and biplane and rotational angiography was performed over the cranium. Coil mass artifact was visualized in the cavernous segment. The stent was poorly visualized and both the intraluminal segment and the junction of the aneurysm parent...
vessel were obscured by superimposition of the coil mass.

Under fluoroscopic guidance, IVUS catheter (Eagle Eye Gold, 20 MHZ Digital, 64 Bement, s5 Imaging System, Volcano Corp.) was introduced through the 6F catheter using 0.014 guide wire (Synchro2TM Standard, Boston Scientific) and advanced into the cavernous part of the left carotid artery (Figure-1A and B). After the scanner of IVUS catheter was placed distal to the aneurysm neck, catheter was slowly pulled back to visualize the stent, aneurysm neck and apposition of coil loops inside the aneurysm and any possible herniated loops of the coil into the parent artery. IVUS images demonstrated that the stent was patent and there was no sign of herniated loops of coil inside the parent vessel (Figure-2A and B). The procedure was completed without any complications and the patient was discharged home the same day.

The 20 mm scanning diameter of the IVUS catheter was limited for visualization of the entirely of the coils inside the aneurysm.

Discussion

Digital subtraction angiography is the gold standard imaging tool during endovascular interventional procedures. As a 2D silhouette of the vessel lumen, angiographic images do have some limitations such as foreshortening of vessels depending on the view and vessel overlap. After coil placement in large aneurysms, it is not infrequent to see superimposition of the aneurysm with coils on the parent vessel obscuring visualization of the aneurysm parent vessel junction. Therefore, it is appropriate to find a reliable adjunct imaging tool which can be used during and/or after aneurysm embolization besides angiography.

IVUS is an adjunct imaging tool that has been extensively used in interventional cardiology during the past two decades. It provides useful information during coronary artery stent placement and leads to reduced rates of stent thrombosis and need to repeat revascularization procedure. In fact IVUS can provide valuable and reproducible information from the vessel wall, lumen, and devices during endovascular procedures which may improve the procedural outcome. Considering the tortuous anatomy of intracranial vasculature, there are limited reports of using IVUS during neuro-interventional procedures. Wehman et al. have reported IVUS guidance during angioplasty and stent placement of two patients with occlusive dissection of the intracranial internal carotid artery and atherosclerotic restenosis of the basilar artery. They concluded that IVUS provided valuable information regarding lesion characteristics, and helped with appropriate stent selection and stent placement. In another study, Yoon et al. performed stent angioplasty of iatrogenic extracranial vertebral artery dissection under IVUS guidance and concluded...
that IVUS is a useful adjunct imaging tool in confirmation of true lumen and ascertaining appropriate stent apposition.

Coil embolization has been proven as a reliable and safe alternative for surgically difficult cavernous carotid aneurysms. Endovascular treatment of giant aneurysms carries less morbidity and provides favorable long-term results. Because of the risk of aneurysm regrowth and reopening, coil compaction and assessment of stent patency in stent-assisted aneurysm embolization, it is routine to perform serial angiographic follow ups at regular intervals after an initial coil embolization procedure. These follow up imaging Studies help neurointerventionalists identify aneurysm recurrence and the need for repeat coil placement or other additional procedures.

In this case report, we showed that IVUS has the potential to be used as an adjunct imaging tool during angiographic follow up of coil embolized aneurysms. By providing intraluminal direct visualization of the vessel wall and aneurysm neck from inside the vessel, IVUS provided us with valuable information regarding patency of the stent inside the vessel, in-stent thrombosis, and coil herniation inside the parent artery.

The new generations of IVUS are expected to be more flexible with smaller profiles promising that intracranial use is feasible and relevant. Adjunct use of IVUS during neuro-endovascular procedures has the potential to provide additional information not ascertained by angiography and to also reduce the need for multiple intra-procedural angiographic images, and radiation and contrast exposure.

References

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Figure-2.
Coil loops are visualized as hyperechoic signal inside the aneurysm (arrow heads in A). In image B, stent is seen patent without any deformity and sign of herniated coil loops.


